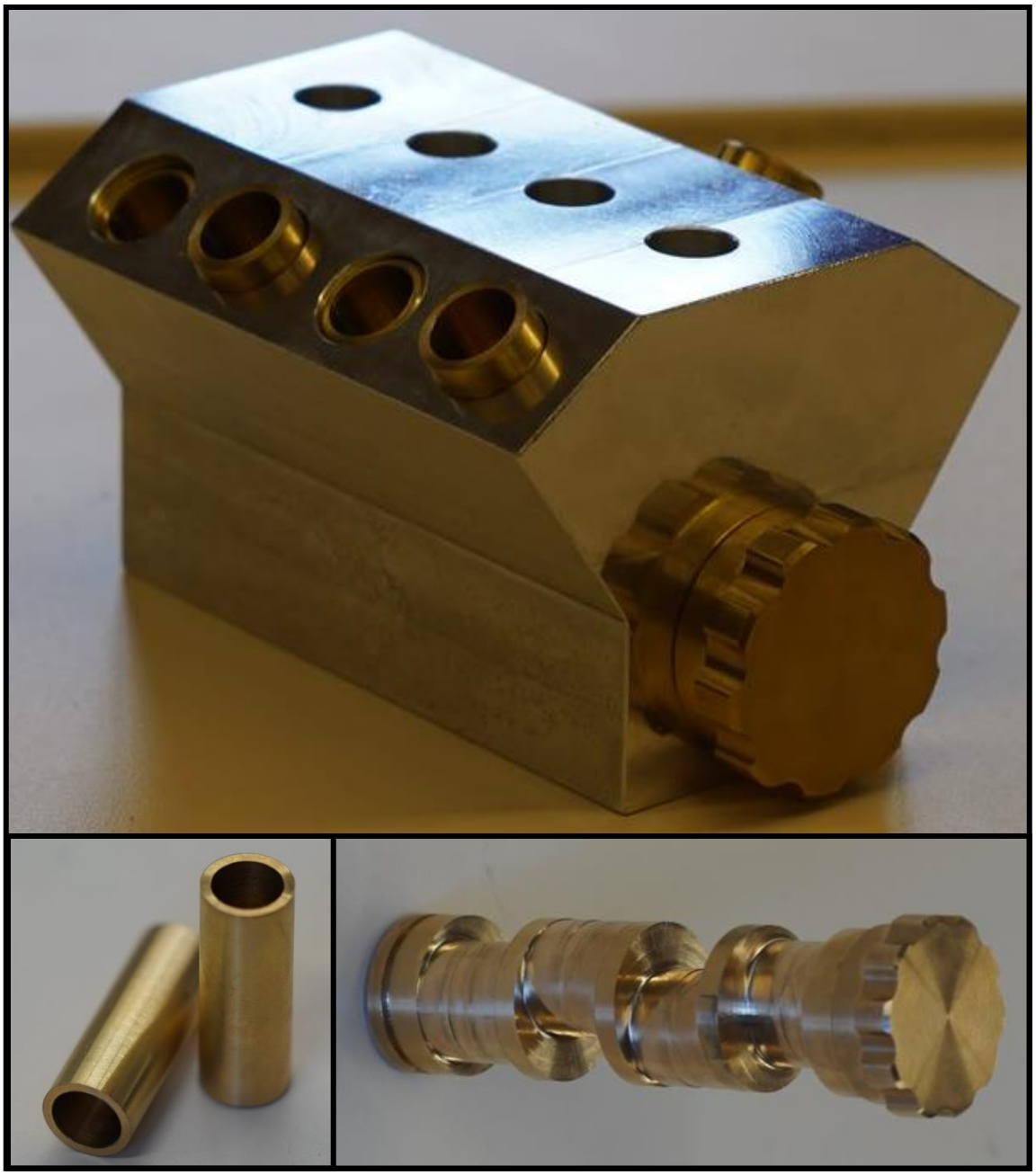
Pen holder – engine block



The CNC4you engine block workpiece is an assembly comprising a total of 10 different parts and a locking ring. Eight brass pistons, an Aluminum engine block and a brass shaft are machined and subsequently assembled. The shaft and pistons are machined on a CNC turning machine with driven tools; in this specific case, an EMCO Turn 365 MC equipped with SINUMERIK 840D sl is used. The engine block was machined on a 5-axis milling center, e.g. on a Spinner U5-620 equipped with SINUMERIK 840D sl.

All the information required for machining, including the set of drawings, tool data, machining plan and NC programs, is listed below.

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1. Safety notes

Using machinery always entails a wide variety of hazards. It is therefore essential that you also strictly observe the customary and statutory safety regulations when manufacturing the engine block.

2. Preliminary remarks

The following description is intended for operators of CNC machines who have experience with or knowledge of the SINUMERIK CNC. All technology data listed here correspond to the machines, tools, materials, work plans, and drawings used in the manufacture of the sample. For remanufacturing purposes, they only serve as a model, on account of the diverse conditions prevailing in other workshops. Nevertheless, it should be possible to reproduce the workpiece without any problem in most cases.

The program code for the engine block was written and tested on a Spinner U5-620 CNC milling machine. The machine is equipped with a SINUMERIK 840D sl. The program code for the shaft and pistons was written and tested on an EMCO Tun 365 MC CNC turning machine. The machine is also equipped with a SINUMERIK 840D sl.

Note: As a rule, the program can be easily adapted to other SINUMERIK versions. Simulation runs and any necessary changes, such as zero-point adjustments, should always be carried out.

The following are available:

- CAD drawings
- Workshop-based program
- SinuTrain program
- Machining descriptions for the individual components

3. Workpieces/blanks/bill of materials

The following blanks are required for this pen holder:

- 100 mm x 100 mm x 115 mm Aluminium block
- ø40 mm x 170 mm brass rod for the shaft
- ø18 mm x 430 mm brass rod for the pistons
- Locking ring according to DIN 471, 30mm diameter

4. Turning machine, milling machine and NC programs

- Turning machine EMCO Turn 365 MC
- Spinner U5-620 milling machine

Machining the engine block:

MOTORBLOCK.MPF: Clamp with a minimum protruding length of 75 mm; however, precisely check for any collision, as the protruding length can vary depending on the specific clamping equipment.

Machining the shaft:

PISTON.MPF: Clamp once with a protruding length of 50 mm.

Machining the pistons:

CRANKSHAFT_A.MPF: Prepare the centering. Then re-clamp the shaft to obtain a protruding length of approximately 160 mm and position the tailstock.

CRANKSHAFT_B.MPF: Machine the locking ring groove and the eccentrically arranged shaft sections. Then reclamp and turn the shaft around.

CRANKSHAFT_C.MPF: Machine the handwheel

5. Tools used

Tools for the engine block:

Tools/program identifier	Description
FACING TOOL	Facing tool ø 63 mm
VHM END MILL 16	End mill ø 16 mm, length
VHM TWIST DRILL 13	Twist drill ø 13 mm, length
INSERT DRILL	Insert drill ø 29 mm, length 100 mm
Boring tool	Boring tool ø 30 mm, length 150 mm
VHM END MILL 10	End mill ø 10 mm

Tools for the shaft:

Tools/program identifier	Description
ROUGHING_T80 A	Roughing tool, longitudinal/face
FINISHING_T35 A	Finishing tool, longitudinal/face
PLUNGE_CUTTER_1,5	Plunge cutter
CENTER DRILL A4_8.5	Center drill ø 8.5 mm
DRILL 12	Drill ø 12 mm
CUTTER_8	End mill ø 8 mm
CUTTER_12	End mill ø 12 mm
PLUNGING TOOL	Plunging tool

Tools for the pistons:

Tools/program identifier	Description
ROUGHING_T80 A	Roughing tool, longitudinal/face
FINISHING_T35 A	Finishing tool, longitudinal/face
DRILL 12	Drill ø 12 mm
PLUNGING TOOL	Plunging tool

6. Machining the individual components

In the following, machining is shown separately for the individual parts.

6.1 Machining the engine block

Machining plan:

1. Read-in the MOTORBLOCK.MPF program
2. Enter measured tools in the tool list
3. Place tools in the magazine
4. Clamp the blank in the vice. When doing this carefully ensure that no collisions occur (if necessary perform air cuts)
5. Set the workpiece zero and start program MOTORBLOCK.MPF
6. If necessary, reclamp and remove the clamping stop

6.2 Machining the shaft

Machining plan:

1. Read-in programs CRANKSHAFT_A.MPF, CRANKSHAFT_B.MPF and CRANKSHAFT_C.MPF
2. Enter measured tools in the tool list
3. Place tools in the magazine
4. Clamp the blank into the chuck with short protruding length. When doing this carefully ensure that no collisions occur (if necessary perform air cuts)
5. Set the workpiece zero and start program CRANKSHAFT_A.MPF
6. Increase the protruding length of the workpiece and position the tailstock
7. Set the workpiece zero and start program CRANKSHAFT_B.MPF
8. Turn over the workpiece and reclamp
9. Set the workpiece zero and start program CRANKSHAFT_C.MPF

6.3 Machining the pistons

Machining plan:

1. Read-in the PISTON.MPF program
2. Enter measured tools in the tool list
3. Place tools in the magazine
4. Clamp the bar material with a protruding length of approx. 50 mm
5. Set the workpiece zero and start program PISTON_C.MPF

7. Information on the Internet

Design of the workpieces, creation of the drawings and drawing-up the machining plans, as well as machining were carried out as part of a project by the HAW Hamburg Department of Mechanical Engineering and Production Management.

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Information data on the Spinner U5-620 and EMCO Turn 365 MC machine tools used in the Internet:

https://www.spinner.eu.com/produkte/detail/5-Achsen%20Fr%C3%A4sen-1.html

https://www.emco-world.com/de/produkte/industrie/drehen/emcoturn.html